

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

RIPARIAN FOREST BUFFER

(Acre)

CODE 391

DEFINITION

An area of trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

PURPOSES

- Create shade to lower **or moderate** water temperatures to improve habitat for aquatic organisms.
- Provide a source of detritus and large woody debris for aquatic and terrestrial organisms.
- Create wildlife habitat and establish wildlife corridors.
- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Provide a harvestable crop of timber, fiber, forage, fruit, or other crops consistent with other intended purposes.
- Provide protection against scour erosion within the floodplain.
- Restore natural riparian plant communities.
- Moderate winter temperatures to reduce freezing of aquatic over-wintering habitats.
- To increase carbon storage.

CONDITIONS WHERE PRACTICE APPLIES

On **stable** areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands and areas with ground water recharge that are capable of supporting woody vegetation.

For areas with unstable banks refer to Streambank and Shoreline Protection - 580.

The riparian forest buffer is a component of a planned land management system including nutrient, pesticide, runoff, sediment, and erosion control practices.

CRITERIA

General Criteria Applicable To All Purposes

The location, layout, **width**, and density of the riparian forest buffer will **be selected to** accomplish the intended purpose and function. ***See General Specifications for required plant densities for buffer plantings.***

All buffers will consist of a Zone 1 that begins at the normal water line, or at the top of the bank, and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the water body.

Dominant **climax** vegetation will consist of existing, naturally regenerated, or planted trees and shrubs suited to the site and the intended purpose. ***Selection of native species will be a priority when feasible. Plantings will consist of two or more species with individual plants suited to the***

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seasonal variation of soil moisture status of individual planting sites. See figure 1. Plant types and species shall be selected based on their compatibility in growth rates, flooding tolerance, ability to produce large debris, and shade and wildlife values. Select species from Tables 1 and 2, Trees and Shrubs Suitable for Establishment located in Appendix I of this standard.

Other species not listed in Tables 1 and 2 may also be suitable. Consult WV Division of Forestry personnel, NRCS staff forester and/or biologist concerning the suitability of other species.

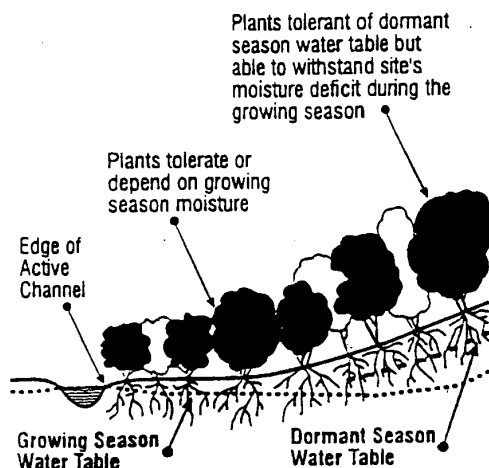


Figure 1. Plant adaptation to soil moisture.

Occasional removal of some tree and shrub products such as high value trees is permitted in Zone 1 provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Harvesting operations in riparian forest buffers must adhere to state and local regulations. Best Management Practices are outlined in Best Management Practices for Controlling Soil Erosion and Sedimentation from Logging Operations in West Virginia (WVDOF-TR-96-3 (June 2001).

An adequate nearby or adjacent seed source must be present when using natural regeneration to establish a buffer.

**NRCS, NHCP
August 2000**

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species.

Only viable, high quality and adapted planting stock will be used.

Site preparation shall be sufficient for establishment and growth of selected species and done in a manner that does not compromise the intended purpose.

See General Specifications for care, handling, and planting requirements of planting stock.

The method of planting for new buffers shall include hand or machine planting techniques and be suited to achieving proper depths and placement of planting stock roots.

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose. **Fenced water course crossings and livestock watering areas shall be located and sized to minimize impact to the riparian buffer vegetation and function.**

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose.

For optimal carbon storage, select plant species that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

Comply with applicable federal, state and local laws and regulations during the installation, operation (including harvesting activities) and maintenance of this practice.

Additional Criteria To Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

An additional strip or area of land, Zone 2, will begin at the edge and up-gradient of Zone 1 and extend a minimum distance of 20 feet, measured horizontally on a line perpendicular to the water body. The minimum combined

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May 2002**

width of Zones 1 and 2 will be 100 feet or 30 percent of the flood plain whichever is less, but not less than 35 feet.

A flood plain is defined as the area adjacent to a river or stream that is built of alluvial sediments that are associated with present depositional activity. Figure 2 illustrates examples of Zone 1 and Zone 2 widths for watercourses and water bodies.

Criteria for Zone 1 shall apply to Zone 2 except that removal of tree and shrub products such as timber, nuts, fruit and forbs is permitted and encouraged on a periodic and regular basis provided the intended purpose is not compromised by loss of vegetation or harvesting disturbance.

Zone 2 will be expanded in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is desired.

Concentrated flow erosion shall be controlled in the up-gradient area immediately adjacent to Zone 2 prior to establishment of the riparian forest buffer. See Figure 3.

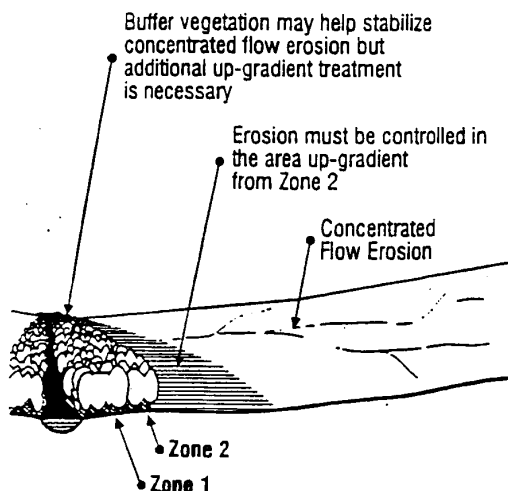


Figure 3. Control of concentrated flow erosion.

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A Zone 3 shall be added to the riparian buffer when adjacent to cropland or other sparsely vegetated or highly erosive areas to filter sediment, address concentrated flow erosion, and maintain sheet flow. The Filter Strip - 393 standard shall be used to design Zone 3.

Fore areas other than those described above, or where the primary purpose of the riparian forest buffer is wildlife habitat, refer to Riparian Herbaceous Cover - 390 for more information concerning Zone 3.

Additional Criteria To Create Shade To Lower Or Moderate Water Temperatures

A buffer for lowering warm-season water temperatures shall consist of at least Zone 1.

Buffers shall be maintained or established on the south and west sides of water bodies insofar as practical. The buffer canopy shall be established to achieve at least 50 percent crown cover with the average canopy heights equal to or greater than the width of the watercourse or 30 feet for water bodies. See Figure 4.

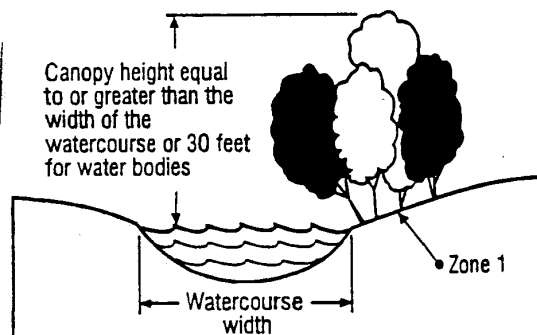


Figure 4. Canopy height for water temperature control.

Buffer species shall include native riparian species of sufficient height and crown density potential. Place drooping or wide-crowned trees and shrubs nearest the watercourse or body. Shoreline or channel relief (e.g. deeply incised channels) and topographic shading should be taken into consideration when selecting species.

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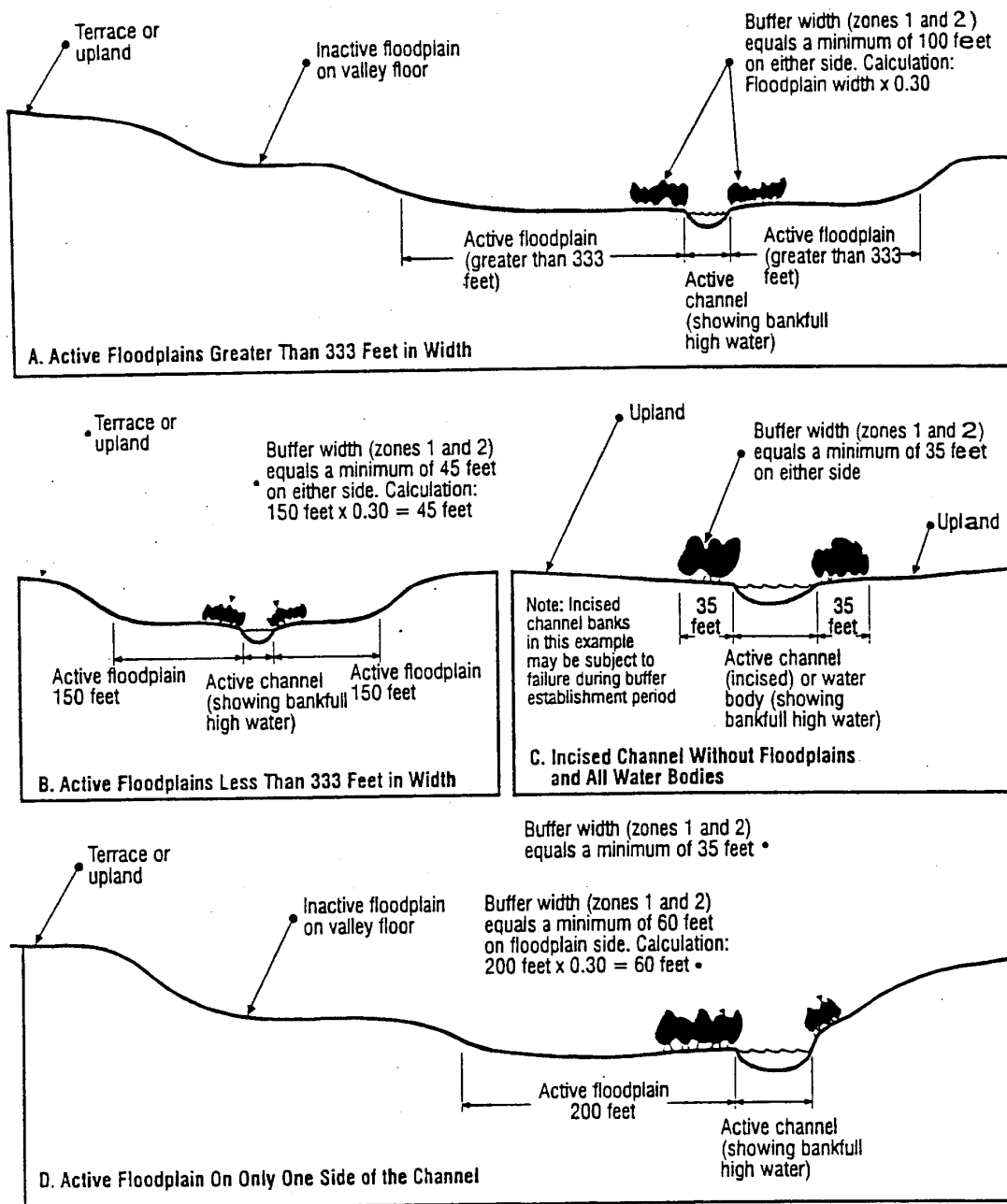


Figure 2. Examples of riparian forest buffer widths for watercourses and water bodies.

Additional Criteria To Provide A Source of Detritus And Large Woody Debris

Within Zone 1, as a minimum, establish, favor, or manage species capable of producing stems and limbs of sufficient size to provide an eventual source of large woody debris (> 10 inches in diameter) for instream habitat for fish and aquatic organisms.

Additional Criteria To Provide Habitat For Aquatic Organisms And Terrestrial Wildlife

Width of Zone 1 and/or Zone 2 will be expanded to meet the minimum requirements of the wildlife or aquatic species and associated communities of concern.

Establish plant communities that address the target wildlife needs and existing resources in the watershed. ***See Wildlife Wetland Habitat Management -644 and Wildlife Upland Habitat Management - 645.***

CONSIDERATIONS

Wide widths (75 feet or more) are preferred. They are more effective for the listed purposes and more feasible to manage. Narrower widths within this standard recognize the value of streamside land for farming and limited bottomland acreage in many locations.

Complex ownership patterns of riparian areas may require group planning for proper buffer design, function, and management.

The severity of bank erosion and its influence on existing or potential riparian trees and shrubs should be assessed. Watershed-level treatment or bank stability activities may be needed before establishing a riparian forest buffer.

When concentrated flow erosion and sedimentation cannot be controlled vegetatively, consider structural or mechanical treatments.

Where animal waste is a problem, management systems must be applied to the adjacent field. Forest buffers should not be planned as substitute practices.

Use of this practice without other nutrient, pesticide, sediment, and erosion control practices can result in adverse impacts on buffer vegetation and stream hydrology. The expected adverse impacts could be high maintenance costs, need for re-establishment of vegetation, and delivery of excess nutrients, sediment, and other potential pollutants through the buffer by concentrated flows.

Joining new buffers with existing buffers increases the continuity of cover and will further moderate water temperatures. A mix of species with growth forms that are tall and wide-crowned or drooping will increase moderation effects. For watercourses, buffers established on both sides will enhance riparian values.

Favor tree and shrub species that are non-invasive, or have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides. ***Consider species that resprout when establishing the vegetation nearest the watercourses or bodies. For detritus and large woody debris, use species that meet the specific requirements of fish and other aquatic organisms for food, habitat, migration and spawning.***

Use recommendations from regional or other large-scale evaluations and plans when designing, locating, and connecting buffers for indicator and/or target species of wildlife, fish, and other aquatic organisms.

Tree and shrub species, which may be alternate hosts to undesirable pests, should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

The location, layout and density of the buffer should compliment natural features, and mimic natural riparian forests.

Consider the type of human use (rural, suburban or urban) and the aesthetic, social, and safety aspects of the area to determine the vegetation selection, arrangement, and management.

Observed species selection criteria to improve aesthetics include seasonal foliage color, showy flowers, foliage texture, form, and branching habit. The layout and design should be appropriate for the setting as determined by adjacent land uses. A landscape analysis can help determine specific aesthetic requirements.

Where feasible, consider alternative water sources, such as tanks, ponds, wells, solar pumps, and ram pumps for livestock water supply needs.

Allelopathic impacts of plants should be considered.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation. ***Requirements for operation and maintenance of the practice shall be incorporated into site specifications.***

The following will be in the conservation plan narrative or in the contract narrative (as appropriate):

Purpose of riparian forest buffer

Size of riparian forest buffer

- width of floodplain (ft.)
- width of riparian buffer (ft.)
- length of riparian buffer (ft.)
- acres of riparian buffer (ac.)

Field location / Plan view

Site conditions prior to establishment of the riparian forest buffer

Soil amendments (if needed)

Site preparation methods (if used)

Plant species

Plant Guides

Plant Sheets

Stock size

Spacing

Planting method(s)

Planting dates

Competition suppression

Protection methods

Cultural practices (i.e. pruning, forest stand improvement, etc.) (if any)

Alternative water source location

Fencing

Erosion control - blanket/mulch

Operation and Maintenance Plan

Replacement strategies

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. ***These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance)***

The riparian forest buffer will be inspected periodically and protected to maintain the intended purpose from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, pesticide use on adjacent lands, livestock damage, and fire.

The buffer should be inspected at least annually and after heavy storm events. Check for areas where water is concentrated. Disperse concentrated flow by appropriate measures, including placement and repositioning debris.

Vehicular traffic or excessive animal traffic, and the removal or disturbance of vegetation and leaf litter must be avoided.

Where practical, management activities will be performed outside the primary nesting season (March 15 - July 15). An exception may be for mowing or cultivation to control vegetative competition.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

As applicable, control of concentrated flow erosion and sediment deposition shall be controlled by an adjacent filter strip.

Any removals of tree and shrub products shall be conducted in a manner that maintains the intended purpose.

Any use of fertilizers, pesticides and other chemicals to assure buffer function shall not compromise the intended purpose.

For the purpose of moderating water temperatures and providing detritus and large woody debris, riparian forest buffer management must maintain a minimum of 50 percent canopy cover.

For the purposes of reducing excess pollutants in surface runoff and shallow groundwater or providing habitat and corridors for wildlife, manage the canopy to maintain maximum vigor of the overstory and understory species.

Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

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**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE GENERAL SPECIFICATIONS**

**RIPARIAN FOREST BUFFER
(Acre)**

CODE 391

GENERAL SPECIFICATIONS

Procedures, technical details and other information listed below provide additional guidance for carrying out selected components of the named practice. This material is referenced from the conservation practice standard for the named practice and supplements the requirements and considerations listed therein.

PLANTING DENSITIES

Initial plant-to-plant densities for trees and shrubs will depend on their potential height at 20 years of age. Heights may be estimated based on: 1) performance of the individual species (or comparable species) in nearby areas on similar sites, or 2) predetermined and documented heights using Tables 1 and 2, Trees and Shrubs Suitable for Establishment located in Appendix I of this standard. Planting density specifications are:

Plant Types/Heights:	Plant-to-Plant Spacing in feet:
• Shrub less than 10 feet in height	3 to 6
• Shrubs and trees From 10 to 25 feet in height (includes columnar trees)	5 to 8
• Trees greater than 25 feet in height	8 to 12

PLANT LIST

Tables 1 and 2 in Appendix I list some common woody plant species (trees and shrubs) associated with and suited to riparian areas. Review the key attributes for each species to assist in selection and the design process for establishing new buffers.

CARE, HANDLING, SIZE AND PLANTING REQUIREMENTS FOR WOODY PLANTING STOCK

Planting stock will be stored in a cool, moist environment (34-38 degrees F) or heeled in. During all stages of handling and storage, keep stock tops dry and free of mold and roots moist and cool. Destroy stock that has been allowed to dry, to heat up in storage (e.g., within a bale, delivery carton or container), or that has developed mold or other pests. Live cuttings that will not be immediately planted shall be promptly placed in controlled storage conditions (34-38 degrees F) and protected until planting time.

Seedlings shall not be less than ¼" in caliper at 1" above the root collar. For cuttings, avoid using material less than ¾" in diameter, cut off tops with apical buds, remove side branches, and produce lengths long enough to reach adequate soil moisture required by the individual species during the growing season. Tops of dormant-season collected cuttings may be dipped into latex paint, paraffin or sealing wax to prevent desiccation and mark the up-end. Rooted planting stock must not exceed a 2:1 shoot-to-root ratio. See figure 1. Container stock shall normally not exceed a 1-gallon can size.

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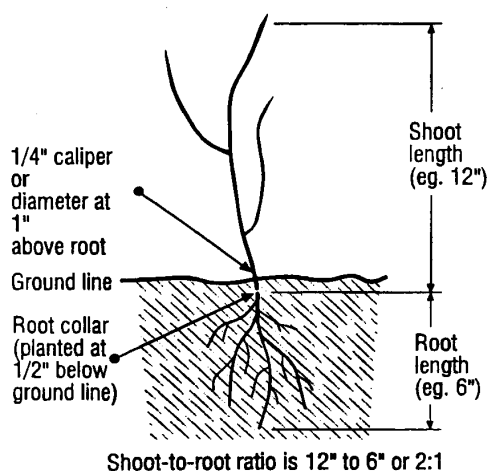


Figure 1. Plant or stock size requirements.

Roots of bareroot stock shall be kept moist during planting operations by placing in a water-soil (mud) slurry, peat moss, super-absorbent (e.g., polyacrylamide) slurry or other equivalent material. Rooting medium or container or potted stock shall be kept moist at all times by periodic watering. Pre-treat stored cuttings with several days of soaking just before planting. Stock shall not be planted when the soil is frozen or dry. Rooted stock will be planted in a vertical position with the root collars approximately 1/2-inch below the soil surface. Insert cuttings to the depth required to reach adequate soil moisture with at least 2-3 buds above ground. The planting trench or hole must be deep and wide enough to permit roots to spread out and down without J-rooting or L-rooting. After planting of rooted stock or cuttings, pack soil around each plant firmly to eliminate air pockets. See figure 2.

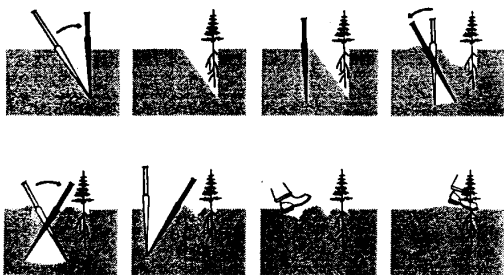


Figure 2. Proper plant and root placement of rooted stock using a planting bar.

BUFFER WIDTH GUIDE FOR SELECTED WILDLIFE SPECIES

Widths below include the sum of buffer widths on one or both sides of water courses or water bodies and may extend beyond riparian boundaries (in such cases refer to Tree/Shrub Establishment, 612, for design of upland forests).

Species:	Desired Width in feet:
Bald eagle, wood ducks, heron rookery	600
Turkey, pileated woodpecker	450
Beaver, black duck, grouse, trout	300
Deer	200
Song birds, mallard	165
Bass, woodcock	100

PREPARATION OF PLANTING SITES

Planting sites shall be properly prepared based on the soil type and vegetative conditions listed below. For sites to be tilled, leave a 3-foot untreated strip at the edge of the bank or shoreline. Avoid sites that have had recent application of pesticides harmful to woody species to be planted. If pesticides are used, apply only when needed and handle and dispose of properly and within federal, state and local regulations. Follow label directions and heed all precautions listed on the container.

Fabric mulch may be used for weed control and moisture conservation for new plantings on all sites, particularly those with pronounced growing season moisture deficits or invasive, weedy species. Refer to Mulching, 484, for installation procedures.

Based on site conditions and predominant soil texture of the fine earth fraction, procedures include:

Tillable sites with loamy/clayey soils

-Sod and alfalfa sites

Summer fallow 1 year to kill the sod or alfalfa. Till (moldboard plow, disk plow, rototiller or similar equipment) in the spring before planting the stock. A fall-sown crop of oats may be used where needed to control erosion.

Sod may be killed by non-selective herbicides the year previous to planting stock. Plant stock in the residue. On heavy soils, tillage is usually necessary to achieve a satisfactory planting when a tree-planting machine is used.

-Small grain or row crop sites

If the site is in row crop, till (moldboard plow, disk plow, rototiller or similar equipment) in the fall or in the spring prior to planting the trees or shrubs. If the site has a plow or hard pan in subsoil, perform a deep disking or ripping operation in the fall. A fall-sown crop of oats may be used where needed to control erosion.

If the site is in small grain stubble, the stock may be planted in the spring without further preparation. If fabric mulch is to be installed, till in the spring before planting.

Tillage on steep slopes must be on the contour or cross-slope. A cover crop between the rows may be necessary to control erosion and sediment deposition on planted stock.

Tillable sites with sandy soils

-Sod and alfalfa sites

Till (moldboard plow, disk plow, rototiller or similar equipment) and plant to a spring cover crop (corn, grain, sorghum, etc.) the year prior to planting. Leave a stubble cover in which to plant. A light disking may be needed before planting if fabric mulch is used.

Sod may be killed by nonselective herbicides the year prior to planting. Plant trees or shrubs in the residue.

When hand planting, scalp or strip an area at least 3 feet in diameter and two-to-four inches deep. (Place plants in the center of the scalped area.)

Rototill a 3-foot wide strip. (Place plants in the center of the tilled area.) Where a drip

watering system will not be used, rototill the strip the year prior to planting.

-Small grain or row crop sites

If the site is in small grain, corn, or similar clean tilled crop, and it is reasonable free of weeds, plant stock in the stubble without prior preparation. It may be necessary to till a narrow strip with a disk or other implement to kill weeds or volunteer grain, or to prevent stalks and other residue from clogging the tree planter. If fabric mulch is used, disking may also be needed. A cover crop or stubble may be needed between the rows to protect the planting from water or wind erosion.

Non-tillable site sand/or erosive sites (including sites with undesirable brushy or herbaceous species)

On sites where it is not practical or possible to operate equipment (steepness, rockiness, etc.), where tillage of the site will cause excessive erosion, or where tillage of the site is impractical, the methods listed below may be used. Sites with undesirable brush will need initial treatments that physically removes and kills the brush species to facilitate planting of desired stock and prevent re-encroachment of the brush. Suitable methods include hand-cutting and removal, brush hogging, brush-blading, or other equivalent procedure with repeated treatment or use of herbicides to control re-sprouting.

Machine or hand scalp an area at least 36 inches in diameter with subsequent plant placement in the center of the scalped area.

Rototill a strip at least 36 inches wide the year prior to tree planting with subsequent plant placement in the center of the tilled strip.

Kill the vegetation in a 36-inch diameter or larger area or in a 36-inch or wider strip with a non-selective herbicide the year prior to planting and plant in the center or along the center-line of the treated area.

PLANTING GUIDELINES

Figure 3 is a simplified drawing depicting the major drainage areas found in a riparian area and is intended to facilitate the plant selection process. Area 1 is made up a poorly drained to somewhat poorly drained soils with the growing season water table (GSWT) fluctuating from 0 to 20" from the soil surface in most years. This area has the greatest potential for inundation.

Area 2 is made up of moderately well to well-drained soils with the GSWT fluctuating from 20 to 60" from the soil surface in most years. This area is prone to moisture stress during the summer months.

The plants in Table 1 have been separated according to their suitability for the conditions in Area 1 or 2. Plants with both areas listed are tolerant of a wide range of conditions.

Species other than those listed may be acceptable as site conditions dictate and the local WVDOF Service Forester, NRCS District Conservationist, and NRCS Staff Forester approve them.

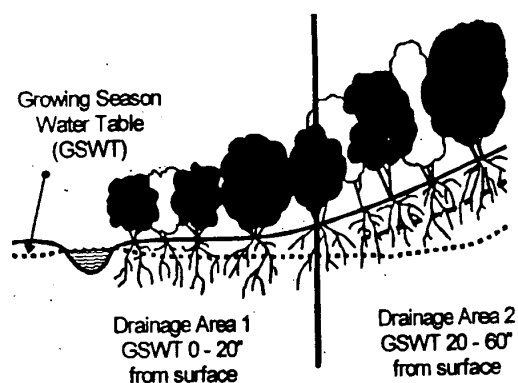


Figure 3. Drainage Class Suitability